Fisheries and Oceans Canada | Pêches et Océans Canada
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Pacific Region

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EVALUATION OF THE INTERNET RECREATIONAL EFFORT AND CATCH (iREC) SURVEY METHODS

Recreational fishing, Pacific Region. Photo credit: Brad Beaith

Figure 1. Map of the area covered by the iREC survey

Context:

Current gaps in survey coverage used to monitor recreational fishing activity in Pacific region tidal waters (e.g. creel surveys) challenge Fisheries and Oceans Canada's ability to estimate total recreational catch and effort, and to conduct stock assessments or other analyses required by international agreements. The internet recreational catch and effort (iREC) survey was developed to provide catch and effort estimates for all areas, months, fishing methods, and species harvested by the recreational sector. To minimize the effect of potential biases in iREC estimates, a calibration procedure was developed to relate iREC estimates and creel survey estimates in areas and times not covered by a creel survey. Fisheries and Oceans Canada (DFO) Fisheries Management requested that DFO Science evaluate the iREC survey design and calibration methodology. This assessment, and advice arising from this Canadian Science Advisory Secretariat Regional Peer Review, can be used to inform recreational catch monitoring planning, including the allocation of creel surveys across months and areas, and as the basis for post-season catch estimates.

This Science Advisory Report is from the June 2-3, 2015 Evaluation of the internet recreational effort and catch (iREC) survey methods. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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SUMMARY

- The internet recreational fishing effort and catch (iREC) survey is a new tool for generating synoptic fisher-dependent estimates of catch and effort for tidal water fisheries. iREC provides estimates of catch and effort for more than 75 species with recreational catch limits across six fishing methods in all Pacific Fishery Management Areas. For most species, the iREC estimates represent the first recreational catch estimates available.
- To address potential iREC survey bias, a procedure has been developed to calibrate iREC catch estimates for boat-based angling, which compares creel and iREC survey estimates for months and areas where they both occur. A comparison of creel and iREC catch estimates demonstrated that the precision of iREC estimates are generally of comparable magnitude to precision of creel estimates.
- iREC survey results presented as heat maps (relative catch and effort across time and space) are considered highly informative because they provide a full picture of fishing effort throughout the year and can assist allocation of catch monitoring resources. Heat maps were found to be consistent with expert knowledge of fishing regulations, fishery characteristics, and patterns of recreational fishing.
- Non-response bias was identified as the most significant among several potential biases. It is recommended that work continue to evaluate and, where possible, improve the iREC survey to address biases. Instantaneous selection and notification at the time of license purchase and improved education of recreational fishers are recommended.
- The iREC survey design was accepted as an appropriate methodology for estimating recreational fishing catch and effort in Pacific tidal waters. However, recommendations for further analysis and modifications to the improve survey design to better estimate uncertainty are provided.
- Recreational catch estimates generated in this assessment are considered the best available at this time. As new data become available, and as survey and/or analytical methods are refined, iREC estimates will be updated.
- It was highlighted that creel surveys remain a necessary part of catch monitoring and are essential for the iREC calibration procedure, and that ongoing resources are required to manage the iREC survey and implement survey improvements, manage data and complete data requests.
- Efforts underway to expand the iREC survey to include recreational fisheries for federally managed species in fresh waters, are encouraged.

INTRODUCTION

Recreational catch estimates in the Pacific Region are based almost exclusively on creel surveys. These estimates only provide total effort and catch estimates for boat-based angling, and only cover certain areas and times. Such coverage gaps challenge Fisheries and Oceans Canada's ability to conduct stock assessments or other analyses required by international agreements (e.g., Pacific Salmon Treaty and Convention between Canada and the USA for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea) or for domestic management (sectoral allocation, Species at Risk Act, Fishery Monitoring and Catch Reporting Strategic Framework).

The "internet recreational catch and effort" (iREC) survey, running as a pilot since July 2012, was developed to fill these coverage gaps in tidal waters, providing catch and effort estimates

for all areas, months, and fishing methods, for all species of interest encountered by those methods.

The iREC survey uses an online survey, conducted monthly, to collect detailed recreational fishing catch and effort information from randomly selected Tidal Waters Sport Fishing Licence holders. Results from the survey provide effort and species – or species-group – specific catch estimates for all areas, months, and fishing methods in Pacific Region tidal waters. As a fisher-dependent survey, the iREC survey is subject to several potential biases. To address biases in iREC catch estimates a procedure to calibrate iREC estimates to creel-survey estimates has been developed.

Two working papers were developed to address the following objectives:

1. Document and evaluate the sampling design and analytical procedures, including the quantification of sampling error, used to estimate recreational catch from the iREC survey.
2. Quantitatively and qualitatively assess validity of the survey results across area, time, species, fishing method and fate (kept and released).
3. Identify and discuss potential sources of bias in these estimates.
4. Develop methods to calibrate iREC estimates to the creel survey.
5. Explore and discuss options, including logistics and other potential constraints, to allocate creel survey or other methods to calibrate iREC estimates.

An evaluation of the iREC survey design, the quality of catch and effort estimates made by iREC over the first 30 months of the survey, and the statistical treatment used to compare estimates between iREC and creel survey estimates was conducted.

ASSESSMENT

iREC Survey Evaluation

The iREC survey involves contacting, by email, a random sample of people who hold a Tidal Waters Sport Fishing Licence valid for fishing, and asking them to report their fishing activity (when, where, how fishing was conducted) and catch (both released and retained catch). Fishing information and catch are reported using an online survey that is accessed via a personalized hyperlink. It is a legal requirement of the licence to complete the iREC survey. The survey has run continuously, with monthly survey periods, since July 2012. Two significant changes in methodology took effect in April 2014: the change to near 100% online fishing licence sales; and, no resampling of licences within a licence year.

The iREC survey provides catch and effort estimates for more than 75 species with recreational catch limits across six fishing methods in all Pacific Fishery Management Areas. For most species, the iREC estimates represent the first recreational catch estimates available.

Response to the survey in its first 30 months was satisfactory. The response rate increased in each year of the survey (mean ~ 30%). Although a much higher response rate could be expected due to the obligatory nature of the survey, the response rate is high in comparison to other online surveys.

Catch estimates generated from the iREC survey to those from creel surveys were compared using linear regression. Regressions of iREC and creel survey estimates for the same month, area and species suggested that the two estimates were similar for commonly captured species, but less similar for rarely captured ones, possibly due to species identification issues in some cases.

Combining estimates across areas and/or months to evaluate whether this could improve the regressions for less common species was recommended.

Results from the iREC survey, particularly the heat-maps (e.g. Figure 2) that demonstrate relative catch and effort across time and space, were considered highly informative because they provide a full picture of fishing effort throughout the year. A review by experts, familiar with the recreational fishery, found among-year consistency and correspondence with factors such as fishing regulations, fishery characteristics, and a general understanding of the patterns of recreational fishing.

The iREC survey design was accepted as an appropriate methodology for estimating recreational fishing catch and effort in Pacific tidal waters. However, recommendations for further analysis and modifications to the improve survey design and better estimate uncertainty include:

- To address non-response bias, identified as the largest concern for iREC, follow-up contact, by e-mail or preferably a telephone survey, to investigate non-response is recommended to ensure that non-response bias is not severe. Further, a more fulsome understanding of causes of non-response could be used to guide communications for promoting survey response; this may include a focus on the need to report if the participant did not fish and to report fishing activity with no catch.
- An improved sampling design for selecting licences to sample each month that would provide for more flexibility in sample allocation, allow use of standard survey analysis algorithms, and have improved statistical properties than the estimates of the current scheme is recommended. Selection and notification during online licence purchase (i.e. instantaneous selection) make implementation of this recommended sampling design possible. Further, instantaneous selection would provide several additional benefits such as immediate notification of survey participation, improve recall by ensuring all fishers know about the survey before they go fishing, and eliminate the need for pre vs post sample stratification. Instantaneous selection provides an important opportunity for improved communications of the requirement of each licencee to complete the iREC survey. These improvements would require the involvement of the National Online Licensing System to incorporate iREC sampling into the licence purchase process and interface.
- The iREC survey calculates catch and effort estimates for every possible combination of month, area, species, and fate, and some estimates are based on small sample sizes. To obtain better precision estimates in these situations, "small areas" estimation techniques that combine information from surrounding areas to arrive at estimates with higher precision were recommended. Guidance from fisheries management to define the level of precision needed for management purposes is required to inform sampling rate requirements for iREC analyses was recommended.
- A variety of other modifications were suggested to improve the survey accuracy and precision. These include reducing the survey period length during months with relatively active fishing (e.g. June-September) to improve response rate and the completeness of responses, screening response data for "outliers", exploring alternative stratification approaches, 'cross-validation' of creel and iREC responses, improving survey interface sophistication, offering delivery on mobile devices, and providing incentives for completing the survey (e.g. a reduction in licence fee the following season).

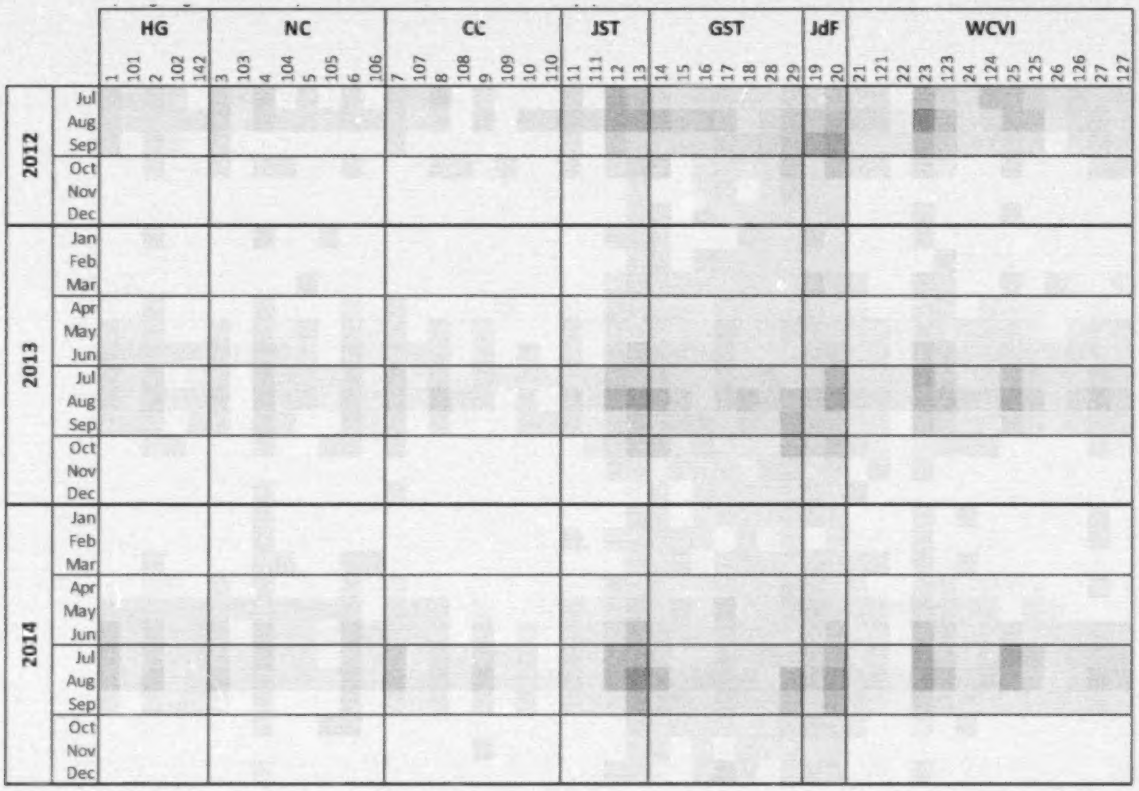

Figure 2. An example effort 'heat-map' of the Angling from Boat fishing method. Heat-maps display relative estimates of recreational effort or catch by month and Pacific Fishery Management area. White cells are estimated zeroes, and darker shading indicates larger estimates, all relative to the heatmap maximum value (red cell). Pacific Fishery Management Areas (PFMAs) are grouped into areas of Haida Gwaii (HG), North Coast (NC), Central Coast (CC), Johnstone St. (JST), Georgia St. (GST), Juan de Fuca St. (JdF) and West Coast Vancouver Island (WCVI).

iREC Calibration

A method to calibrate iREC estimates to creel estimates as opposed to attempting to separately assess and correct for each survey bias source has been developed. The calibration is based on the regression of iREC month-area estimates with compatible creel estimates. The calibration is applied to iREC estimates across months and areas where creel surveys are not available. Total annual recreational catch estimates are derived by combining creel survey estimates for months and areas where they occur, and calibrated iREC estimates for all other times and areas.

Calibration is currently only possible for estimates of effort and catch for angling from a boat. For all other fishing methods, iREC estimates cannot be calibrated with other estimates.

The relative quality of creel surveys, and their use for iREC calibration, was evaluated through a stepwise analysis, but results are confounded with sample size. Further assessment of the implications of creel quality, as well as separate evaluation of the required number of creel area-time estimates to appropriately calibrate iREC, is required. Excluding creel surveys with sampling gaps that do not align with the calibration procedure is recommended until investigations of the implications of creel survey quality on calibrations are completed.

While the calibration method was accepted, because only one potential method was presented, investigation of the use of alternative statistical models (e.g. non-linear) was recommended. In addition, several additional years of iREC data will be needed to assess whether there is any temporal, spatial, or species-specific variability in the calibration over time.

The times and areas to conduct creel surveys to maximize their value for calibration of iREC estimates was explored. Results highlighted that the current prioritization of times and areas for creel surveys; i.e. focusing on methods, times and areas with the highest catches of key species (e.g. Chinook Salmon and Pacific Halibut) appears to be representative of the fishery. Adding creel coverage in times and areas with low expected effort and catch or where creel surveys have never been conducted in the past would be expected to improve calibration. However, the additional resources required to conduct additional creel surveys in these areas may be difficult to justify given the expected small improvements to the estimates. Other data sources that may be used for calibration and/or comparison of iREC estimates include estimates of lodge-based catch from the central coast and estimates derived from catch recorded on licenses.

It was noted that iREC results provide information about recreational fishing activities that can be used to determine recreational monitoring priorities, specifically, when deciding where to implement a more intensive/fisher-independent survey like the creel.

Sources of Uncertainty

The primary sources of uncertainty for the iREC survey design and estimates are non-response bias and other sources of bias (e.g. prestige, gaming) consistent with the fisher-dependent nature of the survey. For the calibration, primary sources of uncertainty are the lack of creel surveys in some areas and lack of catch estimates for methods other than boat-based angling.

The uncertainty in creel survey estimates becomes a significant source of uncertainty when calibrating. It was acknowledged that calibration to less-biased creel surveys was one way to proceed without addressing biases individually, but that a deeper understanding of the implications of bias on the iREC estimates was desirable, especially to improve the iREC survey in the long term. In the short term, focusing on creel surveys of high effort and catch, and in areas with complete interview and flight coverage for calibration, is required.

CONCLUSIONS AND ADVICE

The iREC survey design and calibration approach are appropriate methodologies for estimating recreational fishing catch and effort in Pacific tidal waters. iREC outputs provide important new information about all recreational fishing activities in Pacific tidal waters and can be used to determine monitoring priorities, including decisions that relate to fisher-independent surveys.

Non-response bias was highlighted as the most important issue requiring additional investigation to improve confidence in iREC survey estimates. Instantaneously selecting and informing anglers of their participation in the iREC survey at the time of licence purchase was identified as an important improvement of iREC methodology to address non-response bias. Collaboration with National Recreational Licence System staff to implement instantaneous selection and improve integration of iREC with the licence purchase process is required.

Recreational catch estimates generated in this assessment are considered the best available at this time. As new data become available, and as survey and/or analytical methods are refined, iREC estimates will be updated.

It was highlighted that creel surveys remain a necessary part of catch monitoring and are essential for the accepted iREC calibration methodology, and that ongoing resources are

required to manage the iREC survey and implement survey improvements, manage data and complete data requests.

Efforts underway to expand the iREC survey to include recreational fisheries for federally managed species in fresh waters, are encouraged.

SOURCES OF INFORMATION

This Science Advisory Report is from the June 2-3, 2015 Evaluation of the internet recreational effort and catch (iREC) survey methods. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

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